APPROVED FOR PUBLIC RELEASE
DISTRIBUTION UNLIMITED

REPORT NO. 90-R-03
AFPEA PROJECT NO. 90-P-107

ROBERT TEKESKY

Mechanical Engineer

AUTOVON 787-7445

Commercial (513) 257-4519

Transportable Collective Protection System (TCPS)

HQ AFLC/DSTZ
AIR FORCE PACKAGING EVALUATION ACTIVITY
Wright-Patterson AFB OH 45433-5999

15 August 1990

NOTICE

AFPEA Project No: 90-P-107

Title: Transportable Collective Protection System (TCPS) Testing

ABSTRACT

Human System Division (HSD/YAGD), Wright-Patterson AFB OH 45433-6503 requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to conduct vibration, shock and environmental testing on three Rowley containers with contents. These test were to be conducted by the manufacturer, ILC/Dover, Inc.; however, HSD/YAGD found it would be more cost effective if test were conducted at AF facilities.

The contents consist of a Transportable Collective Protection System (TCPS). The TCPS, manufactured by ILC/Dover Inc., is a chemical warfare tent. Personnel can enter the tent, remove protective clothing, and perform duties in an uncontaminated environment.

Upon completion of AFPEA's evaluation, the three Rowley containers met all the requirements of HSD/YAGD and ILC/Dover Inc. The S/A Container requires some modifications to restrain the aluminum support poles from grinding into each other and gouging the inside walls of the container.

DOD Project No(s): N/A

MANHOURS: 325

PREPARED BY:
Robert A Tekesky
ROBERT TEKESKY, Mechanical Engineer
Materials Engineering Branch
AF Packaging Evaluation Activity

REVIEWED BY:
LARRY A. WOOD
Chief, Materials Engineering Branch
AF Packaging Evaluation Activity

APPROVED BY:
CHARLIE P. EDMONSON
Chief, AF Packaging
Evaluation Activity

PUBLICATION DATE:

TABLE OF CONTENTS

INTRODUCTION

BACKGROUND: Human System Division (HSD/YAGD), Wright-Patterson AFB OH 45433-6503 requested assistance from the Air Force Packaging Evaluation Activity (AFPEA) to conduct vibration, shock and environmental testing on three Rowley containers with contents. The contents consist of a Transportable Collective Protective System (TCPS). The TCPS, manufactured by ILC/Dover Inc., is a chemical warfare tent. Personnel can enter the tent, remove protective clothing and perform duties in an uncontaminated environment.

PURPOSE: The purpose of this project was to determine if the Rowley containers would be able to contain and protect the TCPS during world-wide shipment, storage, and handling.

TEST SPECIMEN: Three Rowley containers were shipped from ILC/Dover with the TCPS packed inside (see figs. 1 & 2). One container contained three TCPS units that could be assembled together. It was classified as a Stand-Alone (S/A) unit. The dimensions of the S/A container was 96" X 84" X 32". Weight was approximately 1700 pounds. The S/A container was subject to Cold and Hot Vibration, Corner and Edge Drop, and Impact testing. The other containers contained only one TCPS unit. These containers were classified as Environment Storage Container (ESC). The dimensions of the ESC were 102" X 42" X 42". Weight was approximately 1200 pounds. One ESC (S/N 004) was subject to Cold Storage and Cold/Hot Cyclic Storage testing. The other ESC (S/N 003) was subject to Hot Storage and Hot/Humidity Storage testing.

TEST OUTLINE: Test plan was developed by HSD/YAGD and ILC/Dover Inc. Test methods and procedures used were as outlined in Federal Test Method Standard No. 101 (FTMS 101) and Military Standard 810 (MIL-STD-810). Any modifications to the standard test methods or procedures are noted in the test plan.

TEST PROCEDURES AND RESULTS:

Test No. 1: FTMS 101, Method 5019.1, Vibration (Repetitive Shock) Test. This test was conducted on the S/A Container at temperatures of -25 Deg. F and 125 Deg. F with a 4.6 hz frequency at 1-inch double amplitude. S/A Container was soaked for 24 hours at temperature prior to test. Duration of test was two hours for each temperature. Test temperature was somewhat difficult to maintain while running vibration table. Breathing of chamber due to the vibration of the table allowed ambient air to enter the chamber. Variation of temperature is shown in table 1.

RESULTS: S/A Container was visually inspected after each test (see fig. 3). Only damage to container was one lost clip (see fig. 4). Minor damage was sustained by the TCPS unit. Aluminum support poles for the unit were damaged. Steel hose clamps (fastened to the aluminum support poles) ground into adjacent poles. Ends of poles also ground into adjacent poles. Ends of poles gouged inside walls of the container (see figs. 5 & 6). No other damage was observed. Functional equipment check was conducted by ILC/Dover at their facility in Frederic, DE.. Test results were not available for this report. S/A Container met all requirements of the test.

Test No. 2: MIL-STD-810, Method 516.3, Procedure IV, Table 516.3-II, Shock (Edgewise Drop) Test. This test was conducted on the S/A Container at ambient temperature. Drop height was 18 inches (see figs. 7 & 8). The test was applied once to each edge of the base of the S/A Container (total of four drops).

RESULTS: S/A Container was visually inspected after each drop. There was no visible damage to the container or TCPS unit (see fig. 9). S/A Container met all requirements of the test.

Test No. 3: FTMS 101, Method 5005.1, Cornerwise-Drop (Rotational) Test. This test was conducted on the S/A Container at ambient temperature. Drop height was 17 inches. The test was applied once to each corner of the base of the S/A Container (total of four drops).

RESULTS: S/A Container was visually inspected after each drop. It was observed that the corners became misaligned and some clips become unlocked (see figs. 10-12). Despite corner misalignment, the TCPS unit was contained. S/A Container met all requirements of the test.

Test No. 4: FTMS 101, Method 5012, Pendulum-Impact Test. This test was conducted on the S/A Container at ambient temperature (see figs. 13 & 14). This test was applied once to each side of the S/A Container (total of four impacts).

RESULTS: S/A Container was visually inspected after each impact (see figs. 15 & 16). A total of six clips were lost. A 4 x 4 wood member on bottom of S/A Container was split. No other damage was observed. The TCPS unit was contained. S/A Container met all requirements of the test.

Test No. 5: MIL-STD-810, Method 501.2, High Temperature (Storagelife) Test. This test was to be conducted at two different temperatures on one ESC container (S/N 003). Once at 165 Deg F and 10 percent or less relative humidity and once at 113 Deg F and 95 percent relative humidity. However, the high temperature chamber used to perform this test cannot control humidity below 20%. HSD/YAGD was informed of the chambers limitations and agree the test would be acceptable if humidity was above 10%. The actual test conditions were 165 Deg F with 15% RH and 113 Deg F with 95% RH. The duration of each test was nine weeks.

RESULTS: ESC container was visually inspected after completion of both tests. Only evidence of visual damage was a slight amount of moisture in one sealed bag. Outside clips were rusted from the humidity but did not hinder containers function. A functional equipment test was performed at ILC/Dover. Test results were not available for this report. ESC container met all requirements of the test.

Test No. 6: MIL-STD-810, Method 502.2, Low Temperature (Storagelife) Test. This test was conducted at -65 Deg F on one ESC container (S/N 004). The duration of the test was nine weeks.

RESULTS: ESC container was visually inspected after completion of test. No evidence of damage was seen. A functional equipment test was performed at ILC/Dover. Test results were not available for this report. ESC container met all requirements of the test.

Note: Several cold chamber breakdowns were experienced during the Low Temperature Test. A complete record of start/stop times is provide in table 2.

Test No. 7: MIL-STD-810, Method 501.2, High Temperature (Storagelife) Test. This test was a cyclic test from a low temperature of -65 Deg F to a high temperature of 165 Deg F. This test was conducted on one ESC container (S/N 004). Duration of test was six weeks. Temperature was held for one week then changed to the other.

RESULTS: ESC container was visually inspected after completion of test. No evidence of damage was seen. A functional

equipment test was performed at ILC/Dover. Test results were not available for this report. ESC container met all requirements of the test.

Note: The cold chamber experienced one breakdown during the Cyclic Temperature Test. A complete record of start/stop times is provided in table 2.

CONCLUSIONS: Upon completion of AFPEA's evaluation, the three Rowley containers met all the requirements of HSD/YAGD and ILC/Dover Inc.. The S/A Container requires some modifications to restrain the aluminum support poles from grinding into each other and gouging the inside walls of the container. When modifications are complete, AFPEA will retest the S/A container in accordance with FTMS 101, Method 5019.1, Vibration (Repetitive Shock) Test.

FTMS 101, Method 5019.1
Vibration (Repetitive Shock) Test

Cold Vibration @ -25 F

Time	Temp. F
8:00:00	-26
8:05:00	-26
8:10:00	-25
8:15:00	-23
8:20:00	-21
8:25:00	-20
8:30:00	-19
8:35:00	-19
8:40:00	-18
8:45:00	-18
8:50:00	-17
8:55:00	-16
9:00:00	-16
9:05:00	-14
9:10:00	-14
9:15:00	-14
9:20:00	-13
9:25:00	-13
9:30:00	-12
9:35:00	-12
9:40:00	-11
9:45:00	-10
9:50:00	-10
9:55:00	-9
10:00:00	-8
Average Temp. F	-16.16

Hot Vibration @ 125 F

Time	Temp. F
13:00:00	125
13:05:00	121
13:10:00	121
13:15:00	121
13:20:00	121
13:25:00	121
13:30:00	121
13:35:00	120
13:40:00	121
13:45:00	120
13:50:00	120
13:55:00	120
14:00:00	120
14:05:00	120
14:10:00	120
14:15:00	120
14:20:00	120
14:25:00	120
14:30:00	120
14:35:00	119
14:40:00	118
14:45:00	118
14:50:00	118
14:55:00	118
15:00:00	118
Average Temp. F	120.04

TABLE 1

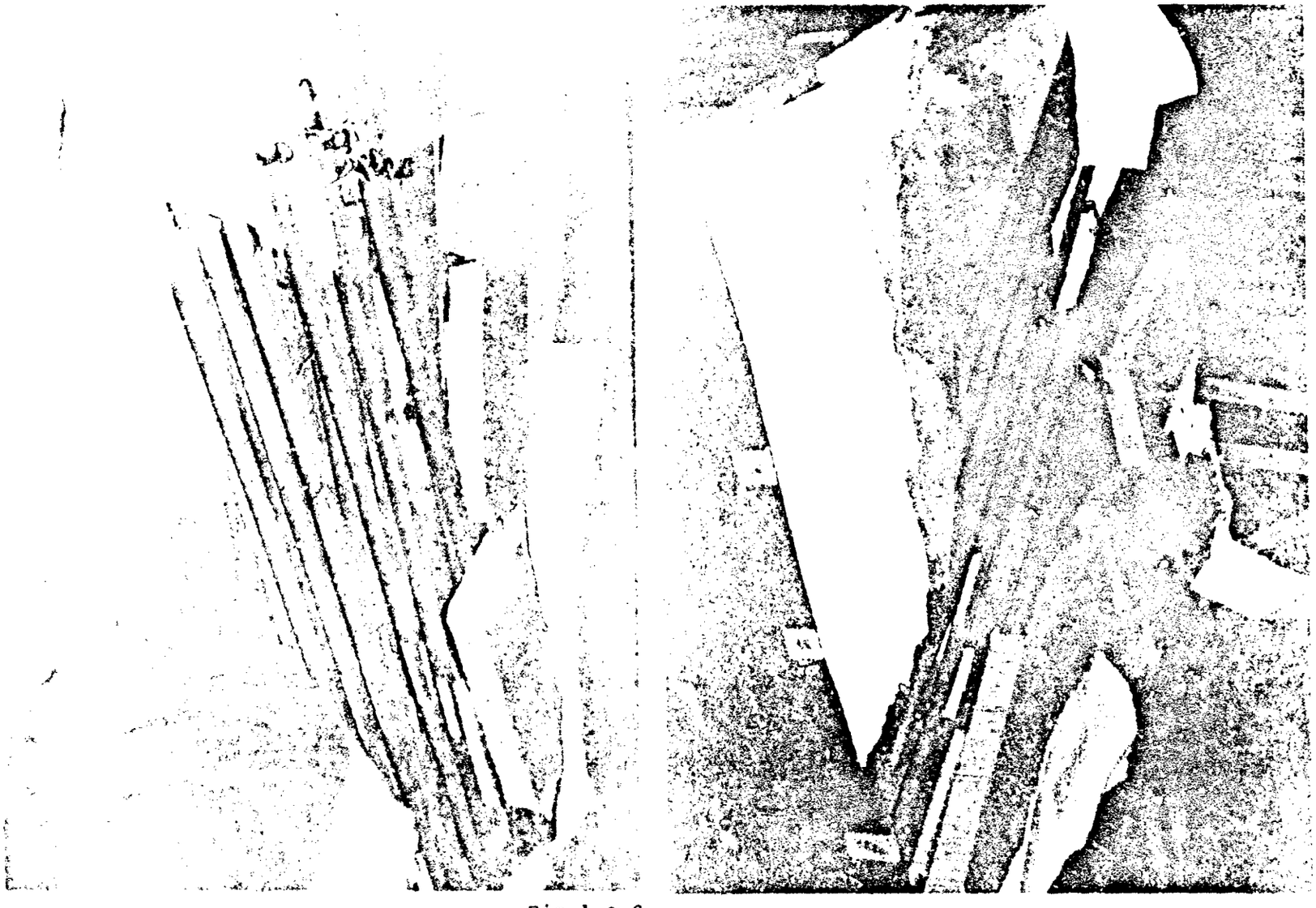


Fig 1 & 2
TCPS Packed Inside
S/A Container

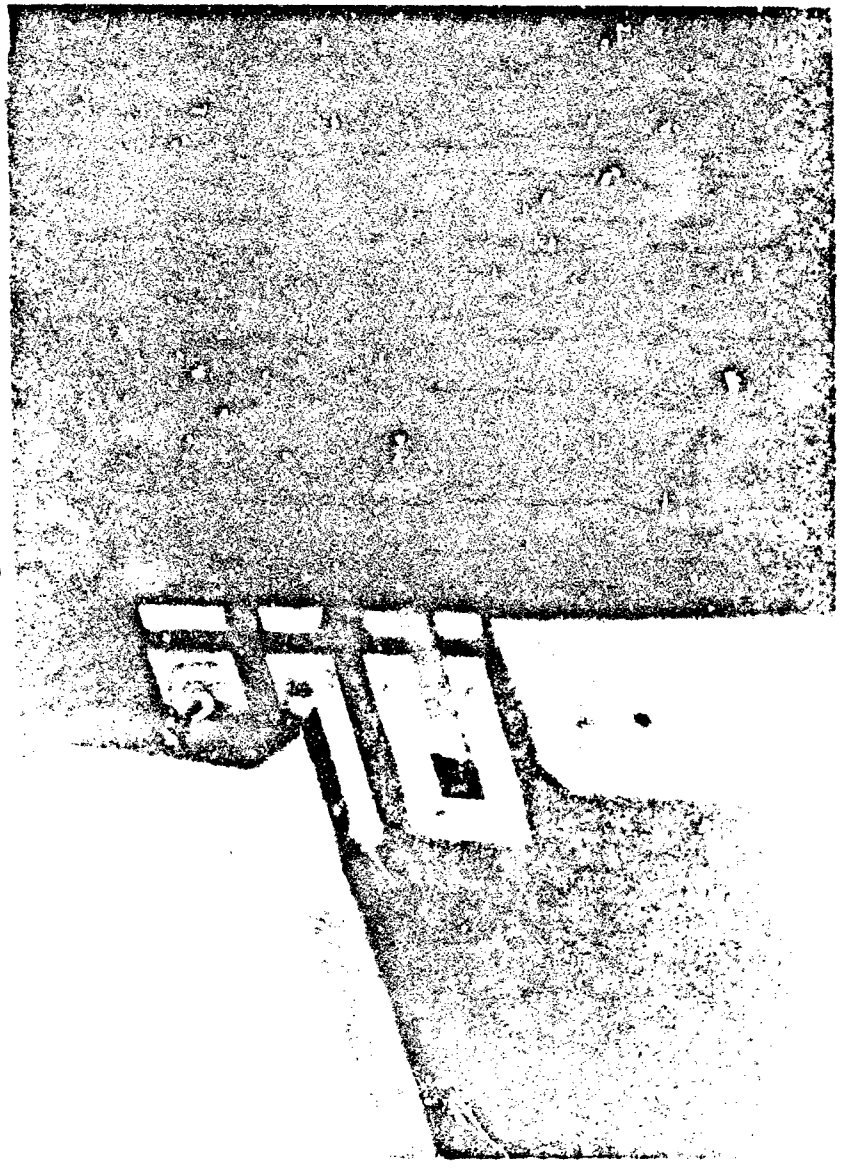


Fig 4
Lost Clip During
Vibration Test

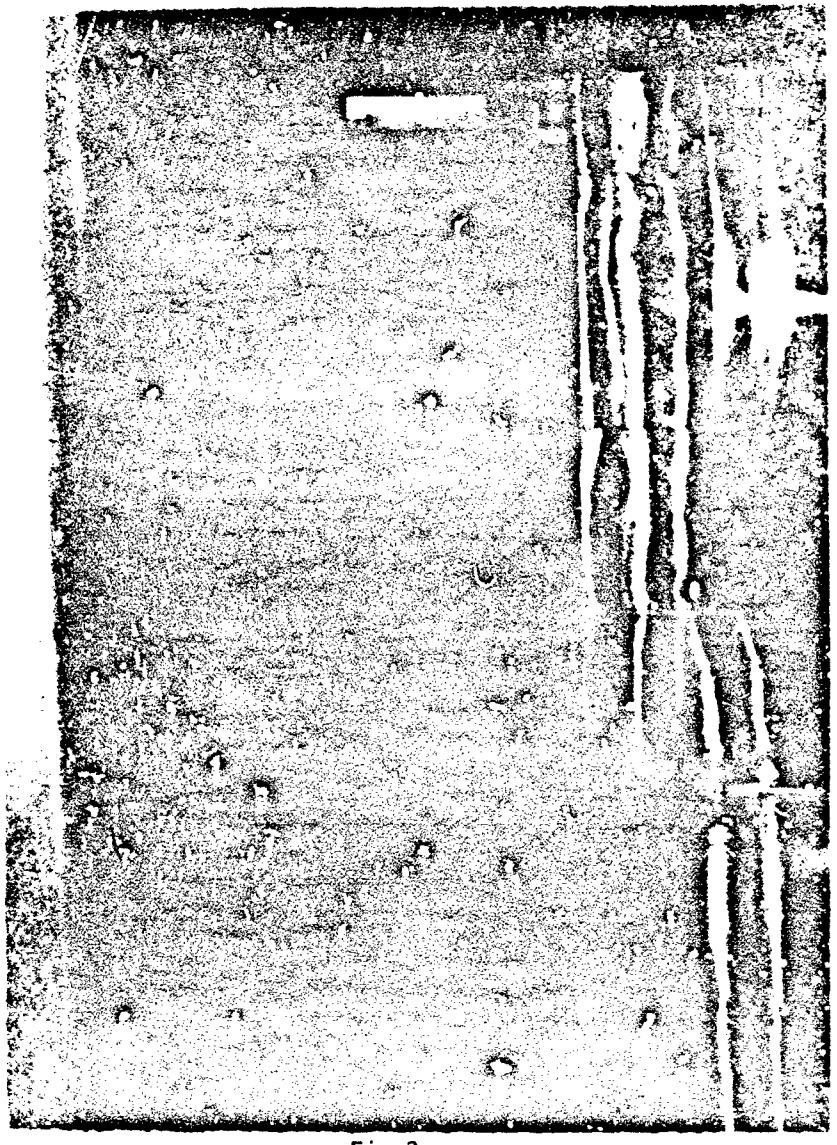


Fig 3
S/A Container in
Vibration Chamber

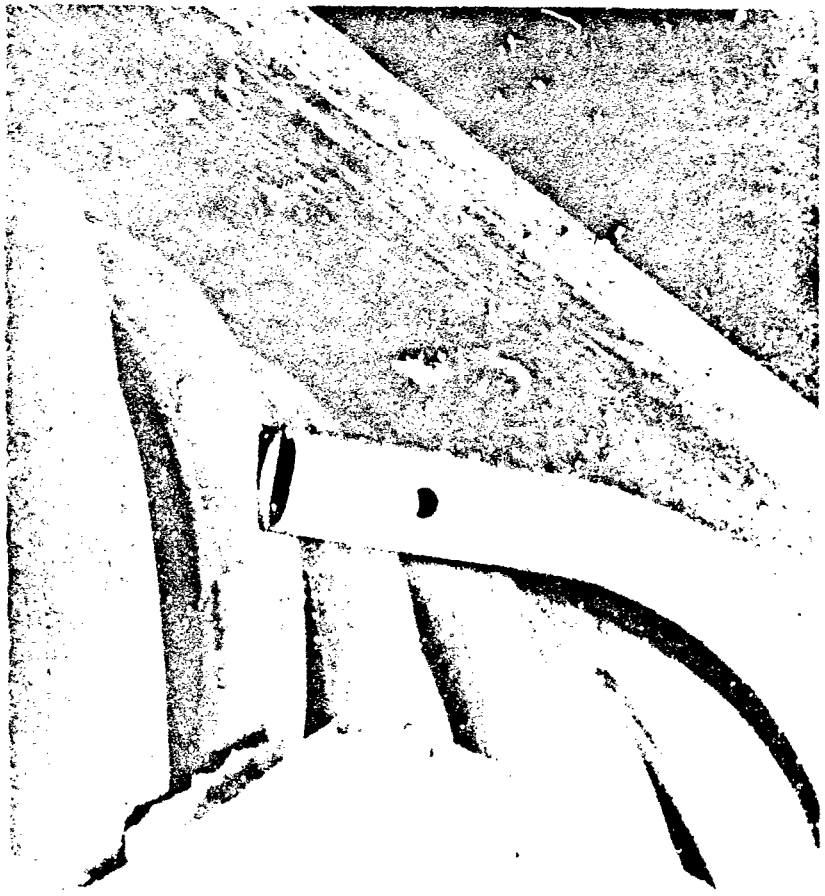


Fig 6
Gouging of Container

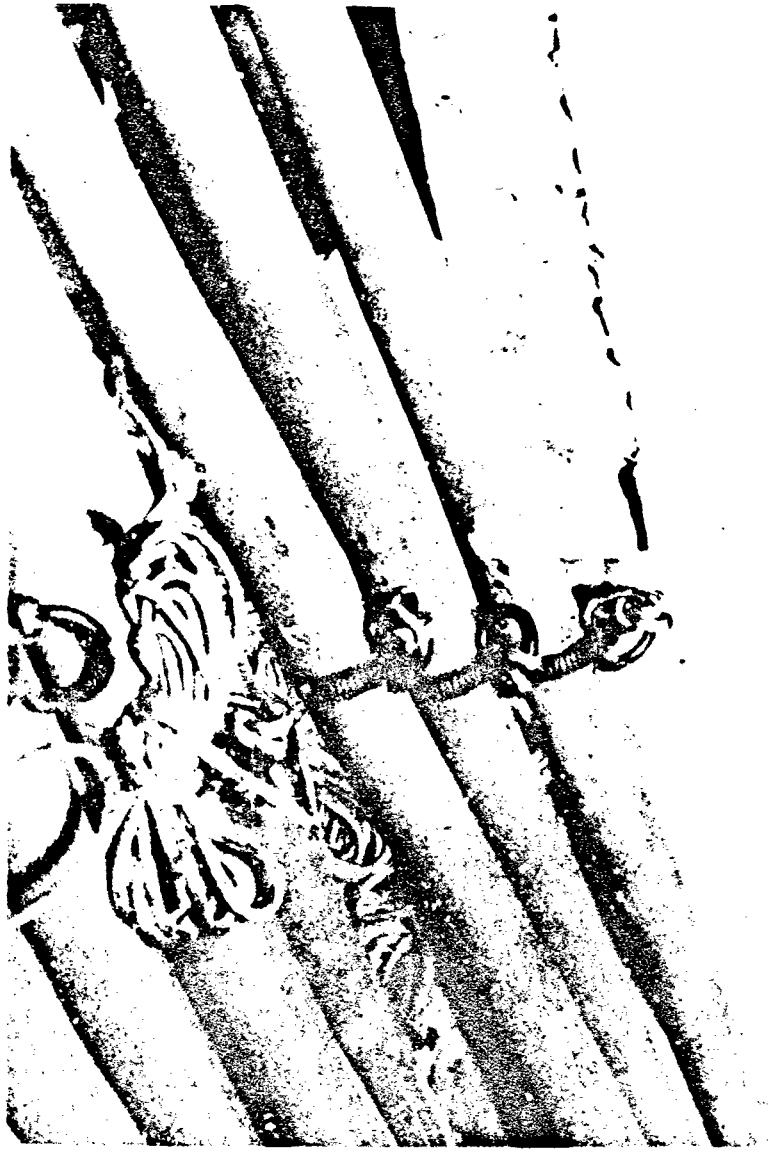


Fig 5
Grinding of Adjacent Pipes

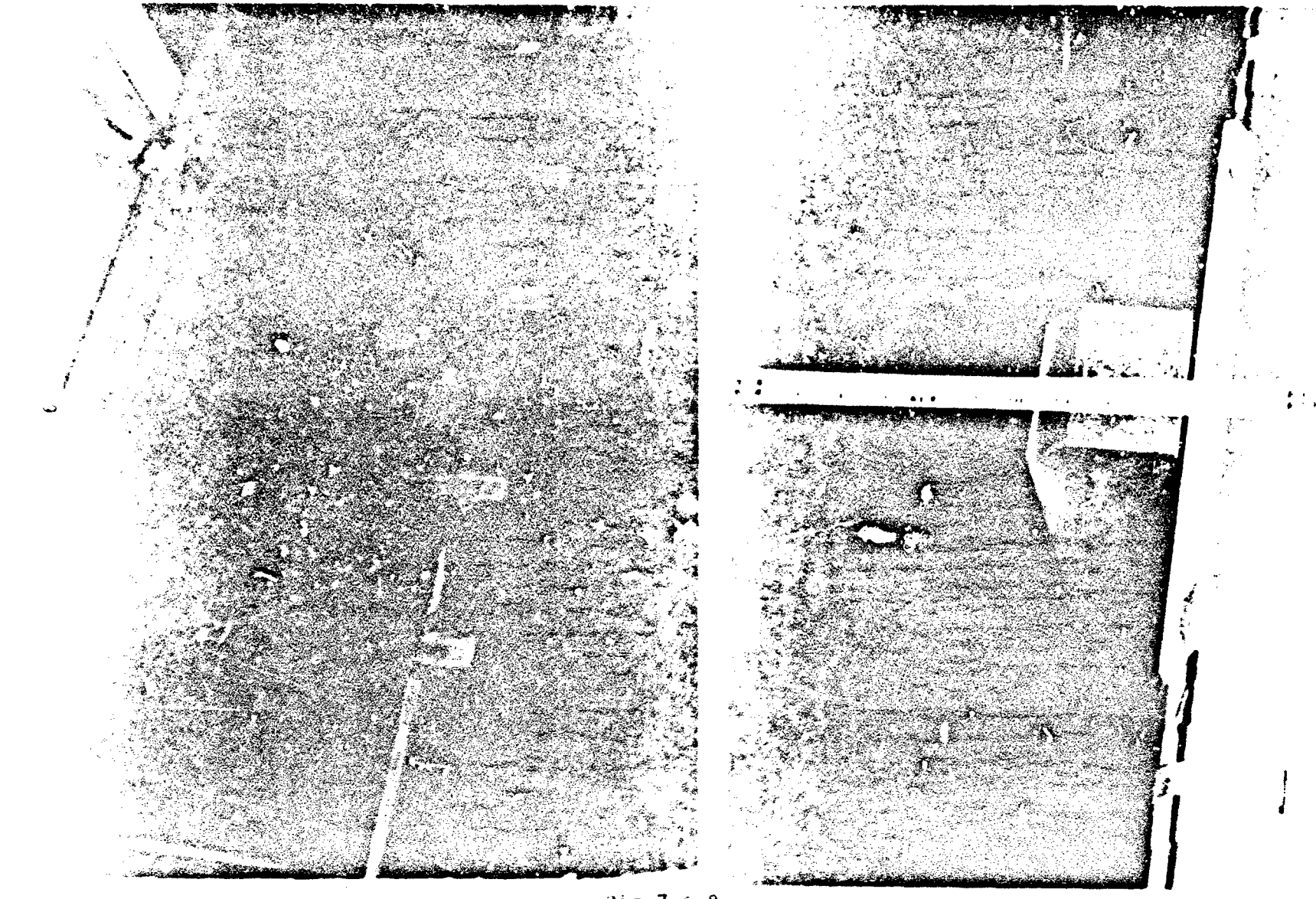


Fig 7 & 8
Edjewise Drop Test

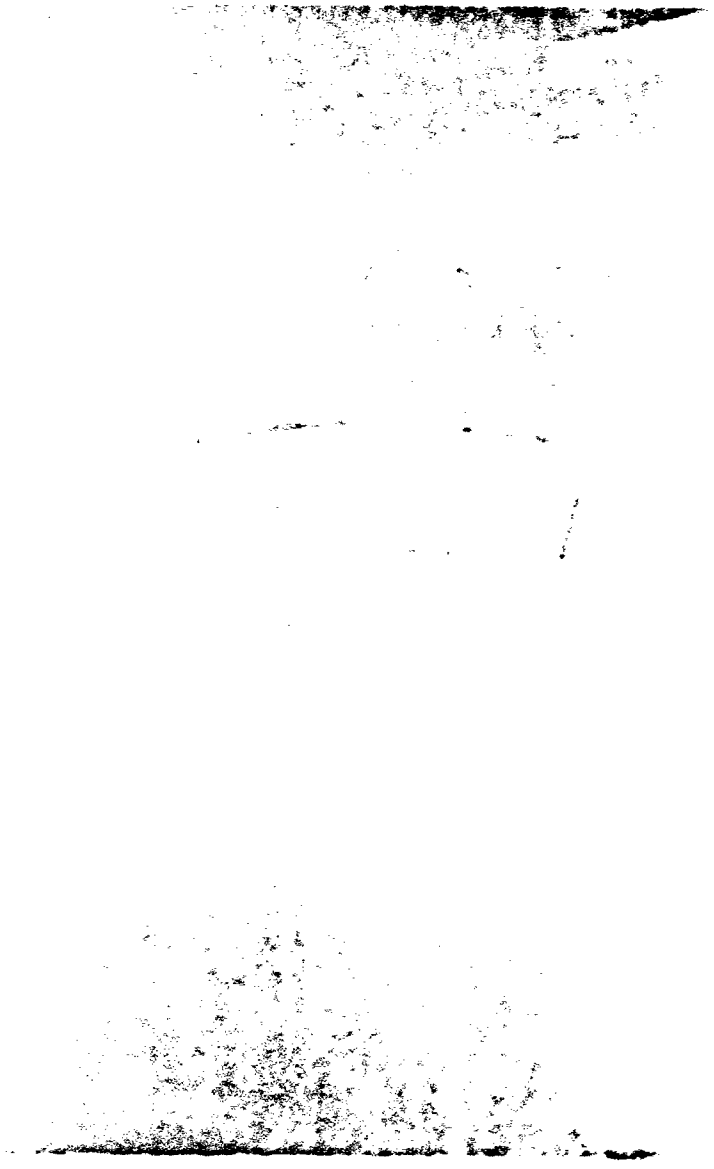


Fig 10
Horizontal Drop Test

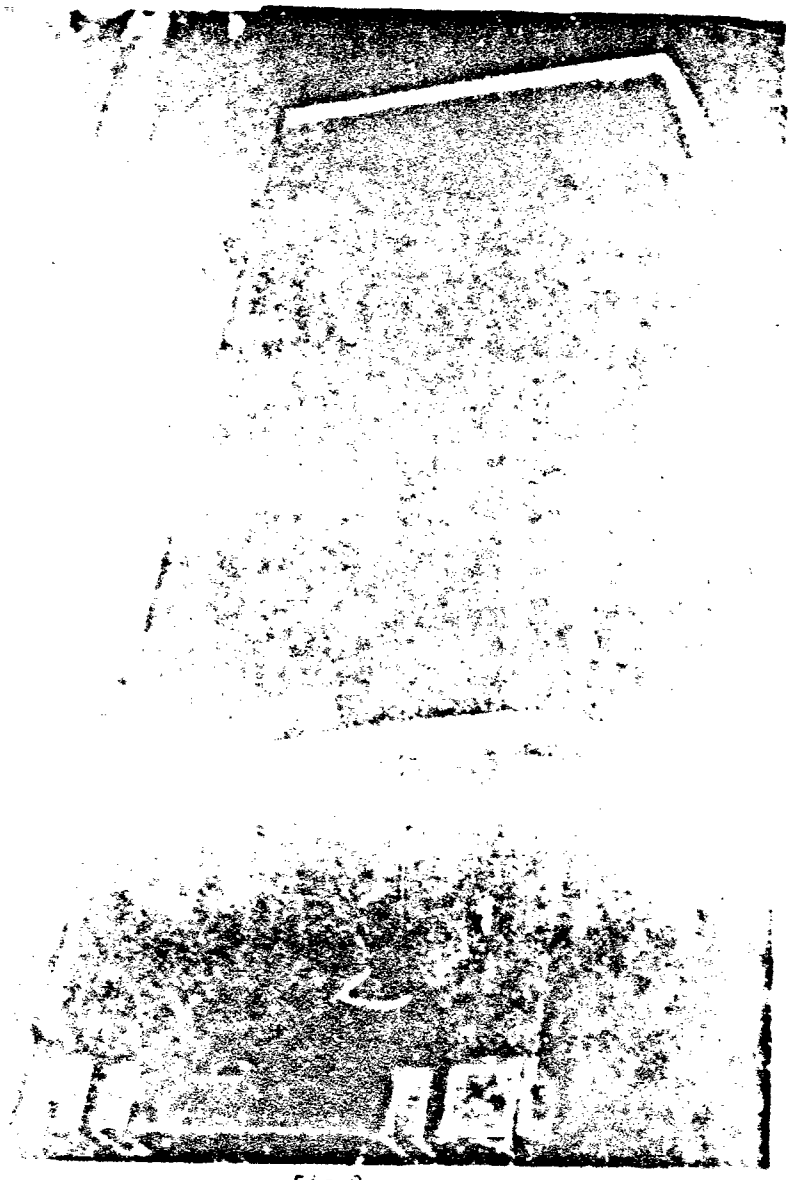
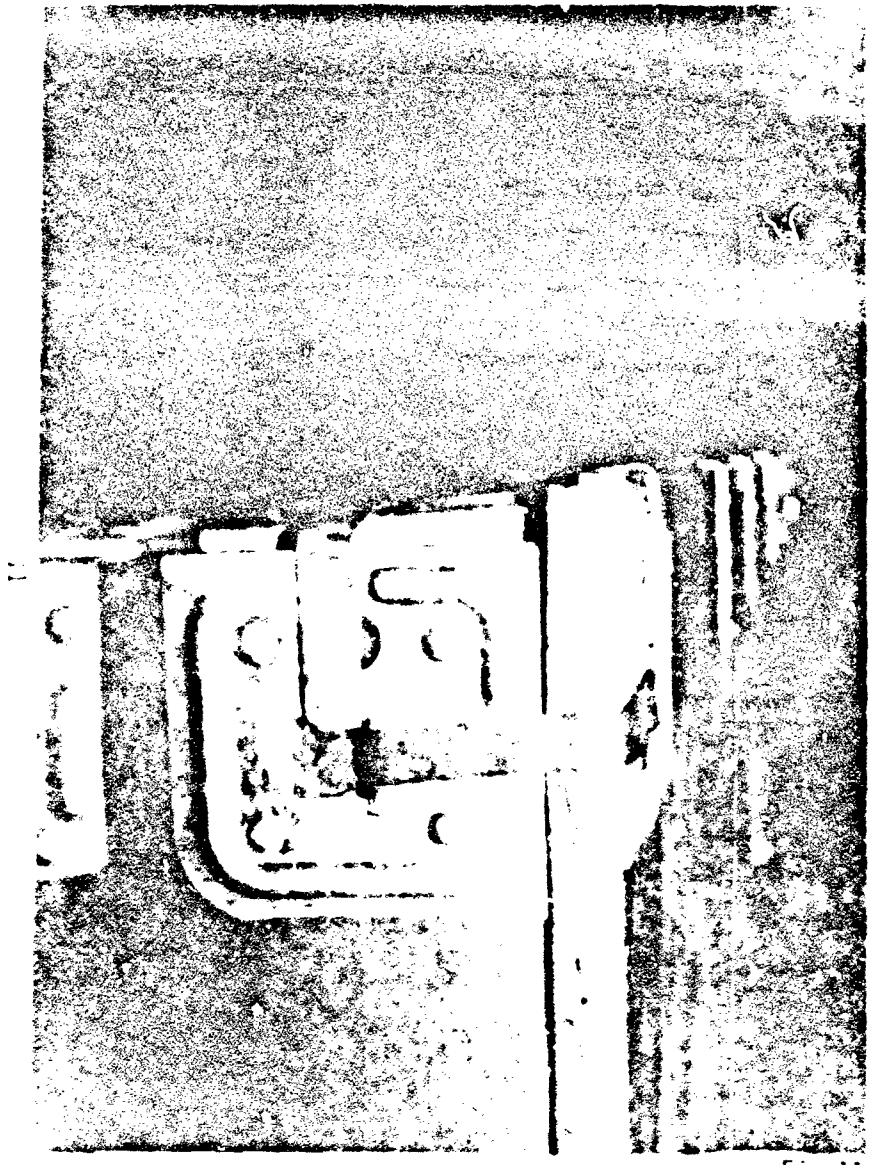


Fig 9
Edgewise Drop Test



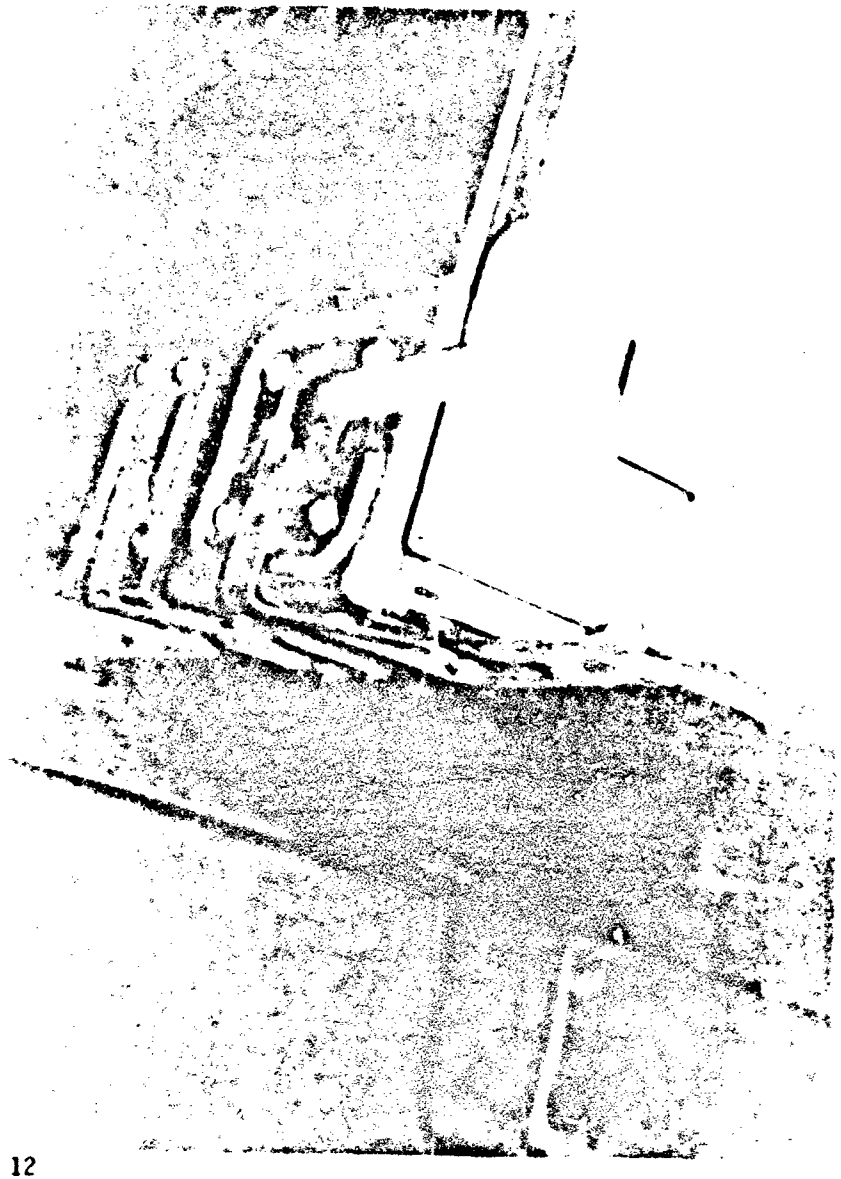


Fig 11 & 12
Corner Misalignment From
Cornerwise Drop Test

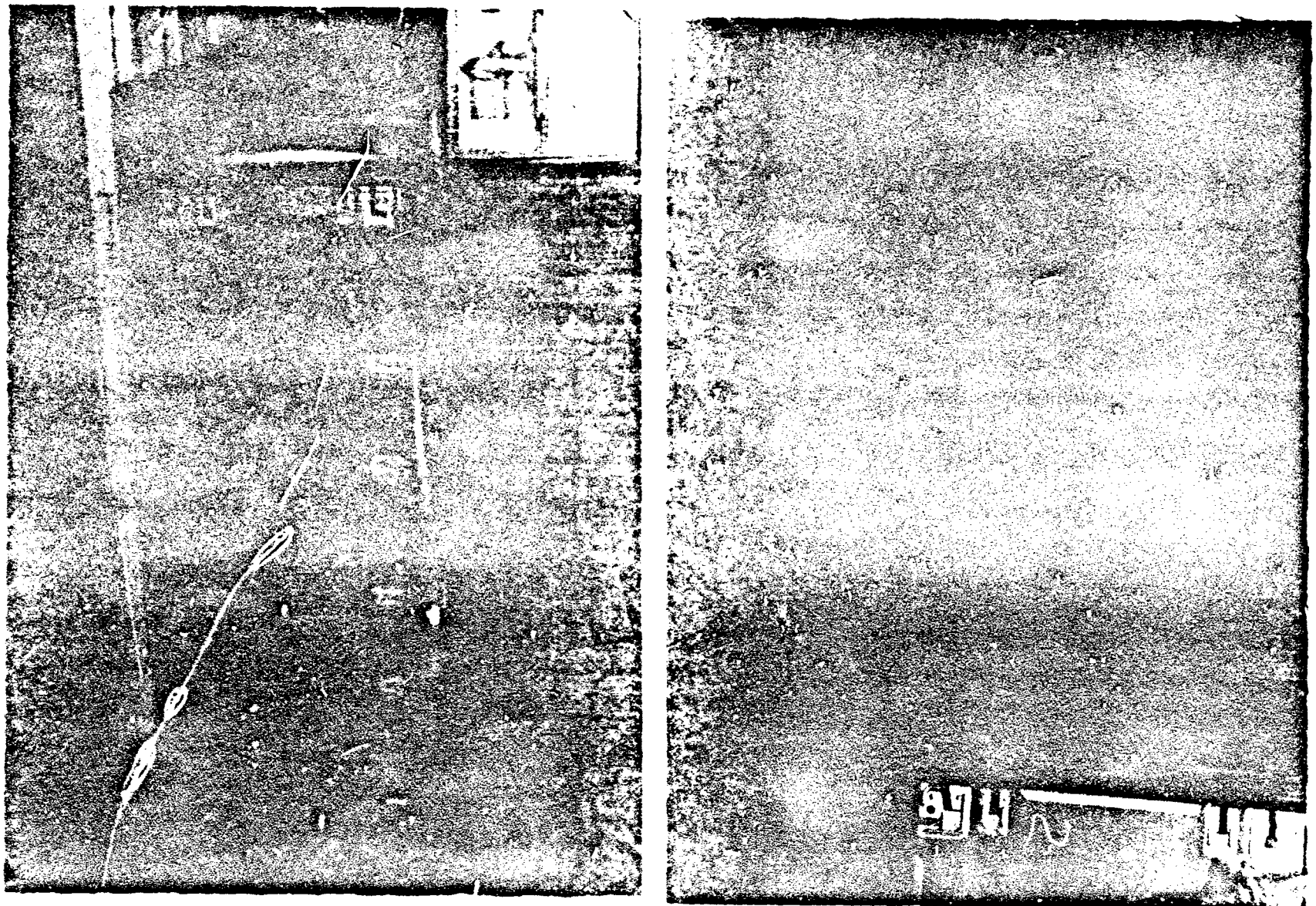


Fig 13 & 14
Pendulum Impact Test

Fig. 15 & 16
Pendulum Impact Test Results

Cold Chamber Down Time

Started Cold Test	13 Feb 90	
Breakdown	26 Feb 90	Replaced circulation motors (temporary)
Restarted Test	6 Mar 90	Down time 8 days
Defrosted Chamber (1 hr)	9 Mar 90	
Defrosted Chamber (2 hrs)	13 Mar 90	Door seal broken
Defrosted Chamber (1 hr)	27 Mar 90	
Defrosted Chamber (1 hr)	2 Apr 90	
Breakdown	3 Apr 90	Fan blades broken & replaced motors
Restarted Test	7 May 90	Down time 34 days
Breakdown	18 May 90	Fractured fan blades
Restarted Test	21 May 90	Down time 3 days
Completed Test	29 May 90	Total test time 63 days
		-- Total down time 45 days --
Started Cyclic Test	31 May 90	
Breakdown	22 Jun 90	Fractured fan blades
Restarted Test	29 Jun 90	Down time 7 days
Completed Test	20 Jul 90	Total test time 42 days
		-- Total down time 7 days --

TABLE 2

DISTRIBUTION LIST

HSD/YAGD ATTN: Capt Paul Hotzoglou	4
ILC/Dover P.O. Box 266 ATTN: Mr Skip Wilson Frederica, DE 19446	2
WR-ALC/DSTP ATTN: Mr Durwood Souther Robins AFB GA 31098	1
ASD/ALXP	1
HQ AFLC/DSTZ Library	10
HQ AFLC/DSTZT ATTN: Mr Robert Tekesky	1
HQ 3246 Test Wing Eglin AFB FL 32542-5000	1
GIDEP Operations Center ATTN: Mr Ken Edwards Corona, CA 91720-5000	1